

PIC Communication Overview

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Communication Between Devices

- **When devices are transferring data between each other, they require:**
 - A protocol which defines how the data are to be extracted from the electrical signal.
 - A means by which to determine the start and the end of the transmission.

Serial Communication Link Characteristics

- **There are two methods used for providing a receiver a way to extract digital information from an electrical signal:**
 - Synchronous Communication – One unit is designated as the master, which transmits a clock that is used to sample the data.
 - Asynchronous Communication – No clock is transmitted; both sender and receiver have a preconfigured bit rate and decoding is initiated when a start signal is detected.

Serial Communication Link Characteristics

- **Data flow between devices can be characterized as:**
 - Full Duplex – Data is transmitted and received simultaneously
 - Half Duplex – The transmission medium is shared and data is either transmitted or received at any given time.

PIC32 Communication Capabilities

- **The PIC32MX795 microcontroller has many Communication Peripherals**

Serial

- 6 – Universal Asynchronous Receiver Transmitters (UART)
 - Two are available for use on the MX7
- 4 – Serial Peripheral Interfaces (SPI)
 - Three are available for use on the MX7
- 5 – Inter-Integrated Circuit Interfaces (I2C, or I²C, or 2-Wire)
 - Two are available for use with daisy-chained connectors and two others can be accessed via the PMOD connectors

Parallel

- Parallel Master Port (PMP)

I²C Interface

- **Characteristics**

- Synchronous
- Uses two signal wires, data and clock
- Half Duplex communication
- Can connect multiple devices in parallel on the same bus
- Requires an address to be transmitted via the data line to identify to which device the communication will take place
- Supports multiple master operation

SPI Interface

- **Characteristics**

- Synchronous
- Uses at least three signal wires, data out, data in and clock
- Full Duplex communication
- Can connect multiple devices in parallel on the same bus
- Requires a dedicated output pin from the microcontroller to select which slave device will communicate, when more than one is connected.
- Number of devices connected in parallel will be limited by the number of output pins available for slave select.

UART Interface

- **Characteristics**

- Asynchronous
- Uses a minimum of two signal wires, Tx and Rx
- Can use two optional flow control signals, Request to Send (RTS) and Clear to Send (CTS)
- Full Duplex communication
- Supports multiple protocols and configurations
- Requires both Sender and Receiver configuration of data rates and protocol options.

Serial Communication Link Comparisons

	Synchronous		Asynchronous
	SPI	I2C	UART
Max Bit Rate	20Mbps	1Mbps	500Kbps
Max Bus Size	Limited by the number of output pins	128 Devices	RS-232 - Point to Point RS-485 - 256 Devices
Number of Pins	3 + N (For SS)*	2	2 + 2 Optional

*N Slave devices connected in parallel

Serial Link Type Comparisons

	PROS	CONS	USES
SPI	Simple Low Cost	Single Master Short Distance	Connect peripherals on the same printed wiring board
I ² C	Small pin count Multiple Masters	Slower Short Distance	Connect peripherals on the same printed wiring board
UART	Longer Distance	Requires accurate clock frequencies	Interface with external peripherals such as data terminals, modems, etc.